(3) In Example 1-A we are only interested if a candy is yellow (Success) or not yellow (Failure). Since we are working with only one proportion, yellow, we can use a one-proportion z-test to investigate if the true proportion of yellow is equal to 1/5. However, in Example 1-B we have 5 hypothesized proportions, one for each color. We need a test that considers all of them together and gives an overall idea of whether the observed distribution differs from the hypothesized one. We have specified a model for the distribution and want to know whether it fits. Hypothesis test only. There is no single parameter to estimate, so a confidence interval wouldn't make much sense.

/* Fill in table while discussing below */
Looks like it's time for something new. What we have to start with? We have an observed count for each category of the variable from the data, and have an expected count for each category from the hypothesized proportions. We wonder, are the differences just natural sampling variability, or are they so large that they indicate something important? Naturally enough, we look at the differences between these observed and expected counts, denoted (Obs – Exp). We'd like to think about the total of the differences, but just adding them won't work because some differences are positive, others negative. We've been in this predicament before – once when we looked at deviations from the mean to develop standard deviation $s = \sqrt{\frac{\sum (x-\bar{x})^2}{n-1}}$ and again in linear regression when we calculated the observed value – predicted value know as residuals.

In fact, these are residuals. They're just the differences between the observed data and the counts given by the (null) model. We'll handle these residuals in essentially the same way we did before: We square them. That gives us positive values and focuses attention on any cells with large differences from what we expected. Because the differences between observed and expected counts generally get larger the more data we have, we also need to get an idea of the relative sizes of the differences. To do that, we divide each squared difference by the expected count for that cell. Now if we sum all these components we get a new test statistic called the chi-square ("ky" as in "sky"):

$$\chi^2 = \sum_{all\,cells} \frac{(Obs - Exp)^2}{Exp}$$